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NOTES ON THE WORM SNAKES OF THE SOUTHWEST, WITH DESCRIPTIONS OF TWO NEW SUBSPECIES.

BY

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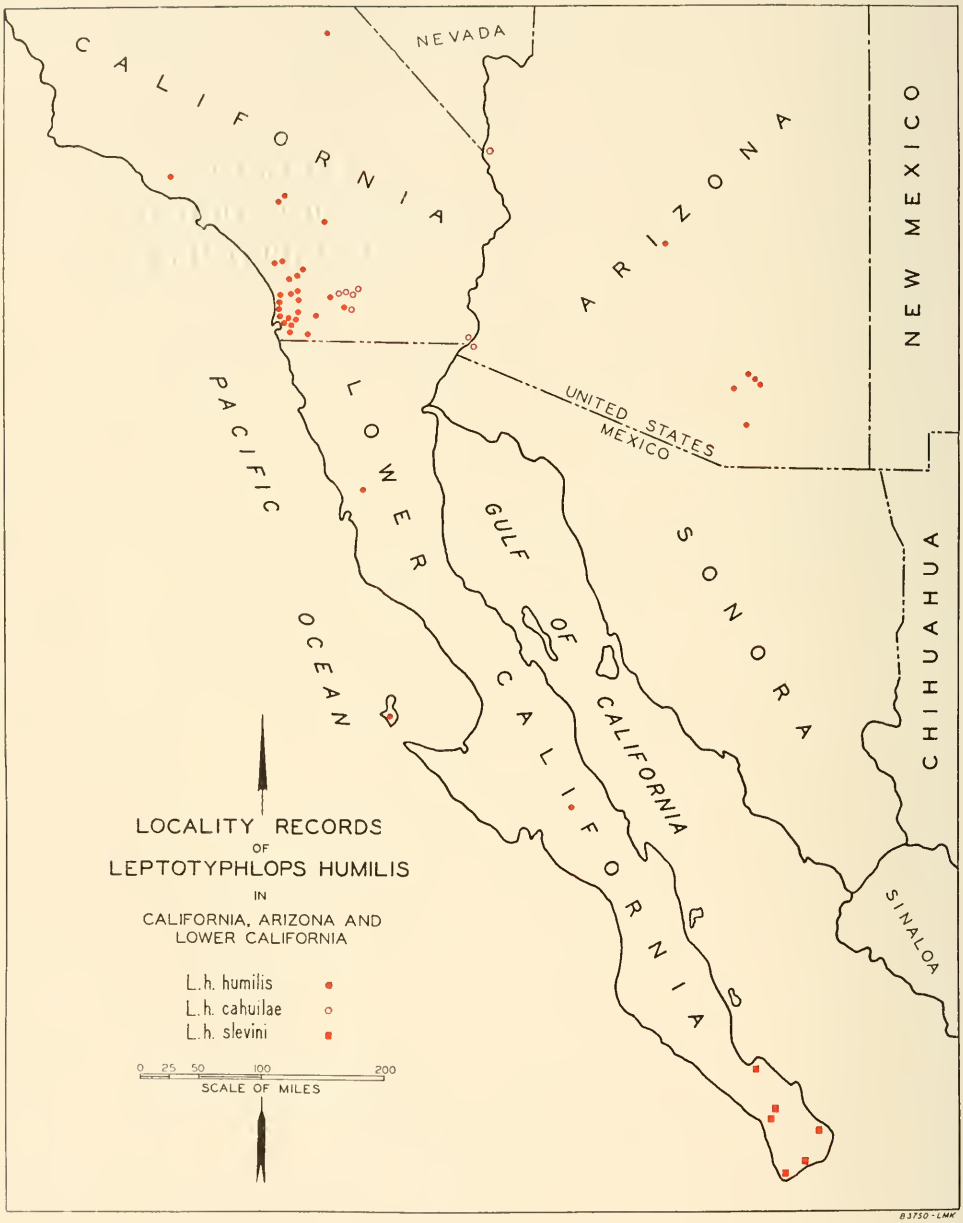
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SINALOA
LOCALITY RECORDS
OF
LEPTOTYPHLOPS HUMILIS
IN
CALIFORNIA, ARIZONA AND
LOWER CALIFORNIA
L.h. humilis
L.h. cahuilae
L.h. slevini
0 25 50 100 200
SCALE OF MILES
B3750-LMK

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INTRODUCTION

Recently in the course of an investigation of ophidian color variations in the species found along the southern border of California, with particular reference to the differences between coastal and desert specimens, I was struck by the marked and consistent contrast of the worm snakes of the species *Leptotyphlops humilis* as found in the two areas. Following up this suggestive lead has resulted in determining that this worm snake, which occurs in the southwestern United States, and central and northern Mexico, may be classified into at least three subspecies, and others are to be expected when more material is available from Mexico.

SUMMARY OF *Leptotyphlops* (*Siagonodon* GROUP)

The worm snakes of the genus *Leptotyphlops* may be divided into two groups, or subgenera, those with and those without supraoculars. The first group is evidently the more widespread and probably considerably the more numerous in both species and individuals. The presence (or absence) of supraoculars has often been considered a generic character, the name *Siagonodon* having been proposed by Peters (1881) for those snakes having no supraoculars. But in the present notes I follow such recent authors as Ruthven,[1] Barbour and Loveridge,[2] and do Amaral,[3] and give this character only specific weight.

At this time the following American species without supraoculars are ordinarily recognized as valid:

Leptotyphlops septemstriata (Schneider)

1801. *Typhlops septemstriatus* Schneider, Hist. Amph., Vol. 2, p. 341. (Type locality, not stated).

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1 1907, p. 573.
2 1929, p. 294.
3 1929a, p. 76; 1929b, p. 138.

1844. *Catodon septemstriatus* Dumeril and Bibron, Herp. Gen., Vol. 6, p. 319.
1864. *Stenostoma septemstriatum* Jan, Icon. Gen., p. 39.
1881. *Siagonodon septemstriatus* Peters, Sitzb. Ges. Natur. Freunde, p. 71.
1893. *Glauconia septemstriata* Boulenger, Cat. Snakes British Museum, Vol. 1, p. 71.
1925. *Leptotyphlops septemstriatus* Mertens, Senckenbergiana, Vol. 7, p. 78.
1929. *Leptotyphlops septemstriata* Amaral, Mem. Inst. Butantan, Vol. 4, p. 76.

Habitat: Rio Negro, Amazonas, Brazil (Mertens, 1925).

Leptotyphlops humilis (Baird and Girard)

1853. *Rena humilis* Baird and Girard, Cat. N. Amer. Rept., Pt. 1, p. 143. (Type locality, Valliecitas, Calif.)
1857. *Stenostoma humile* Peters, Monats. Akad. Wiss. Berlin, p. 402.
1881. *Catodon dugesii* Bocourt, Bull. Soc. Philom., Ser. 7, Vol. 4, p. 81. (Type locality, Colima, Mexico).
1882. *Siagonodon dugesii* Bocourt, Miss. Sci. au Mex., Rept., p. 507.
1884. *Stenostoma tenuiculum* Garman, Mem. Mus. Comp. Zool., Vol. 8, No. 3, p. 5. (Type locality, San Luis Potosí, Mexico).
1893. *Glauconia humilis* Boulenger, Cat. Snakes British Museum, Vol. 1, p. 70.
1897. *Siagonodon humilis* Van Denburgh, Occ. Papers Calif. Acad. Sci., 5, p. 150.
1907. *Leptotyphlops humilis* Ruthven, Bull. Am. Mus. Nat. Hist., Vol. 23, No. 10, p. 573.

Habitat: Southwestern Texas to the coast of southern California; central and northern Mexico and the peninsula of Lower California.

Leptotyphlops borrichiana (Degerboel)

1923. *Glauconia borrichiana* Degerboel, Vidensk. Medd. Naturh. Foren., Vol. 76, p. 113. (Type locality, Santa Rosa, Mendoza, Argentina).
1929. *Leptotyphlops borrichiana* Amaral, Mem. Inst. Butantan, Vol. 4, p. 139.

Habitat: Mendoza, Argentina.

These partial synonymies are merely given to summarize the New World forms of the genus, which lack supraoculars (subgenus *Siagonodon*). I make no pretense of discussing all of these forms; in fact these notes are not only restricted to *L. humilis,* but, owing to lack of adequate material from Mexico, must be virtually limited to the forms found in the United States and Lower California. Thus, I cannot make a complete division of the species into subspecies; *dugesii* and possibly

tenuiculum as well may be valid subspecies of *L. humilis;* this can only be determined as more material becomes available. From the original descriptions I do not think they anticipate the new subspecies here proposed.

MATERIAL

The following discussion is based on complete examinations of the specimens of *L. humilis* listed below:

San Diego County, California (Coastal)	17	
San Diego County, California (Desert)	7	
Los Angeles County, California	3	
Riverside County, California	1	
Inyo County, California	1	
Total California		29
Cape Region, Lower California	9	
Central Lower California	2	
Cedros Island	1	
Total Lower California		12
Western Desert Area, Arizona	5	
Eastern Plains Area, Arizona	10	
Total Arizona		15
Texas		1
Mexico (Mainland)		2
Grand Total		59

About 35 specimens have been seen alive, all from California.

For comparative purposes 21 specimens of *Leptotyphlops dulcis* from Texas, Oklahoma, New Mexico, Arizona and mainland Mexico have been available.

DIFFERENTIAL CHARACTERISTICS

The scale formulas and arrangements in these worm snakes are so simple that conspicuous differential characteristics are few. The small size, lack of formal pattern and cylindrical shape all render checking and segregation difficult. Many specimens in collections are found to be rather poorly preserved because of the delicacy of the material.

The particular characteristics which I have found of most interest in subdividing *L. humilis* are: The ratio of the length of body to diameter; the number of scales in the median dorsal row from rostral to tip of tail; the depth of color on the dorsal scale rows; and the number of rows so

colored, particularly at mid-body. Of these the number of scales in the median dorsal scale row appears to be the most definite, and does not seem to have been used before. In the worm snakes the dorsals are easier to count than the ventrals, as the latter are particularly small and irregular below the head and neck.

By the use of these characteristics two well defined subspecies are segregated from typical *L. humilis*.

New Subspecies

Leptotyphlops humilis slevini subsp. nov.

San Lucan Worm Snake

Type.—No. 53721 in the collection of the California Academy of Sciences. Collected at La Paz, Lower California, Mexico, by J. R. Slevin, June 2, 1921.

Diagnosis.—A subspecies of *Leptotyphlops humilis* having a low dorsal scale count, low ratio of length to diameter, and five lightly or moderately colored dorsal scale rows, whereas the typical form has seven dark rows.

Description of the Type.—Adult. Length over all 207 mm.; length of tail 9.5 mm. Ratio of total length to tail length 21.8. Diameter of body 4.9 mm. Ratio of length to diameter 42.3. The body is almost cylindrical, the head being little distinct and the tail likewise. The latter terminates in a sharp spine.

The head is slightly depressed with a prominent overhanging snout. The rostral is high, wide and recurved. A large nasal plate touching the median dorsal row is divided behind, but not before, the nasal opening. A large ocular plate extends from the central dorsal row to the mouth on each side. The eye appears as a black dot below the surface of the ocular. There is a supralabial on each side between ocular and nasal, and a second behind the ocular, thus making four scales in contact with the mouth between the rostral and commissure. There is a large parietal and an occipital behind each ocular, both in contact with the median dorsal row. There are four infralabials on each side. The chin shields are small.

The body is covered with 14 rows of hexagonal scales, smooth and markedly imbricate. The ventral row is lightly enlarged, otherwise all dorsal and ventral body scales approach equality in size. The anal is entire. The median dorsal scales number 244 from rostral to tail spine.

The five median dorsal scale rows are light yellow-brown, the color being applied by a multiplicity of dots. Below the color is cream. These notes have reference to a specimen as preserved in alcohol.

Range.—This subspecies occurs in the Cape region of Lower California, Mexico. Areas of intergradation are discussed elsewhere.

Material—Variations.—The following specimens of this form have been examined, all being from the Cape region of Lower California.

Specimen	*Number*	*Locality*	*Dorsals*	*L/D*	*Pattern*
CAS (Type)	53721	La Paz	244	42	5 med. yellow-brown
AMNH	5576	Cape San Lucas	250	46	5 med. brown
MVZ	11850	Eureka	251	47	5 med. brown
MVZ	11851	Eureka	253	44	5 med. brown
USNM	5292 (A)	Cape San Lucas	259	54	5 lt. brown
USNM	5292 (B)	Cape San Lucas	246	45	5 lt. brown; 7 caudad
USNM	12601	La Paz	247	48	5 med. brown
USNM	64580	Cape San Lucas	257	46	Unicolor (condition?)
Stanford	4118	San José del Cabo	263	44	5 dark brown

Leptotyphlops humilis cahuilae subsp. nov.

DESERT WORM SNAKE

Type.—No. 2637 in the collection of LMK. Collected at Yaqui Well, San Diego County, California, May 15, 1930, by the County Road Camp.

Diagnosis.—A subspecies of *Leptotyphlops humilis* differing from the typical form in possessing a higher average dorsal scale count, and by having five lightly punctated dorsal scale rows, instead of seven dark chocolate-brown rows as in *L. h. humilis*. From *L. h. slevini* it differs in a conspicuously higher dorsal scale count.

Description of the Type.—Adult. Length over all 232 mm.; length of tail 13.5 mm. Ratio of total length to tail length 17.2. Diameter of body 4.7 mm. Ratio of length to diameter 49.4. The body closely adheres to a cylindrical shape, the head being little distinct from the neck, and the tail but slightly diminished in diameter. It terminates in a sharp spine.

The head is slightly depressed, with a prominent overhanging snout. The rostral is large, wide and recurved. A large nasal plate in each side reaches the median dorsal row and is divided behind, but not before the nasal opening. This is followed on each side by a supralabial which does not contact the median dorsal row. Next comes a large ocular on each side extending from the dorsal row to the mouth; the eye appears as a black dot under the surface. Following the ocular there is another supralabial on each side, thus making four scales in contact with the mouth. Above, behind the ocular and touching the median dorsal row there is a parietal and an occipital on each side. There are four infralabials on each side, the other chin shields being small and irregular.

The body is covered with 14 rows of scales, smooth and imbricate. These rows are practically equal throughout, the median ventral not being enlarged. The anal is entire. The median dorsal scales number 282 from rostral to tail spine.

The five median dorsal scale rows are faintly brownish. The color is applied as punctations in the central area only of each scale. Elsewhere and below the color is cream. This refers to an alcoholic specimen.

Range.—This subspecies occurs in the Colorado and Yuma Deserts of California and Arizona along the lower desert fringes of the Peninsula range and along the banks of the Colorado River. It may occur in the desert between. It will probably be found in northeastern Lower California. Possible areas of intergradation are discussed elsewhere.

Material—Variations.—The following specimens distinctly of this subspecies have been examined:

Specimen	*Number*	*Locality*	*Dorsals*	*L/D*	*Pattern*
LMK (Type)	2637	Yaqui Well	282	49	5 light brown
LMK	2635	Yaqui Well	284	52	5 light brown
LMK	2636	Yaqui Well	300	61	5 faint brown
LMK	2760	Yaqui Well	280	50	5 light brown
LMK	2905	Yaqui Well	294	52	5 light brown
LMK	4102	San Felipe Wash	298	53	5 faint brown
SDSNH	12496	Agua Caliente Spr.	301	58	5 faint brown (a few on 7)
USNM	15943	(Ft.) Yuma	279	54	Unicolor (preservation?)
USNM	26289	(Ft.) Yuma	294	....	Unicolor (preservation?)
USNM	37114	Ft. Mohave	282	53	5 medium brown

(Note: All LMK and SDSNH specimens are from San Diego County, California; USNM 15943 and 26289 are recorded as being from Fort Yuma, Arizona. Fort Yuma was on the California side of the river, while the town of Yuma was (and is) on the Arizona side, in Yuma County. Thus there may be some doubt as to the side of the river on which these two specimens were collected. Ft. Mohave is in Mohave County, Arizona.)

Comparison of Subspecies

For comparative purposes the following schedule is presented of specimens of *L. h. humilis,* all of which are from San Diego County, California, in the vicinity of the type locality of the typical subspecies:

Specimen	*Number*	*Locality*	*Dorsals*	*L/D*	*Color of 7 dorsal rows*	*Next row each side*
LMK	100	San Pasqual	268	56	Dark brown	Heavily mottled
LMK	860	Santa Fe Ranch	281	52	Dark brown	Half colored
LMK	861	Santa Fe Ranch	275	47	Dark brown	Part colored
LMK	1032	San Pasqual	268	52	Dark brown	———
LMK	1033	San Pasqual	263	53	Dark brown	Heavily mottled
LMK	1065	San Diego	271	57	Dark brown	Part colored
LMK	2955	Red Mountain	265	57	Dark brown	Heavily mottled
LMK	2956	San Diego	281	47	Dark brown	Part mottled

LMK	2957	Bernardo	270	59	Dark brown	Part mottled
LMK	3228	San Diego	281	47	Dark brown	Part mottled
SDSNH	12069	San Diego Co.	266	53	Dark brown	Part mottled
SDSNH	15550	San Diego	277	48	Dark brown	Part mottled
MVZ	10189	Lemon Grove	281	57	Dark brown	Part mottled
CAS	53933	Rose Canyon	281	61	Dark brown	Part mottled
CAS	58132	Palomar	273	52	Dark brown	Part mottled
CAS	58160	San Diego Co.	276	51	Dark brown	Part mottled
CAS	62992	San Diego Co.	266	60	Dark brown	———

A number of additional specimens have been checked insofar as the number of dark brown dorsal scale rows is concerned; all were found to have seven fully pigmented, with the color usually straying onto the next row on either side.

As far as the three subspecies *L. h. humilis, L. h. slevini* and *L. h. cahuilae* are concerned they are quite distinct and easily classified. Not a single specimen has been seen from within the territory of any subspecies which is not clearly and definitely of that subspecies. The important differences are summarized in the following table:

Subspecies	*No. Specimens*	*Dorsal Scales*	*Ratio L/D*	*Marked Dorsal Rows*
Humilis	17	263-273-281	47-53-61	7 dark
Cahuilae	10	279-289-301	49-54-61	5 light
Slevini	8	244-252-263	42-46-54	5 light-med.

(The outer figures indicate the range; the central figure indicates the average.)

We see that *L. h. humilis* differs from both of the other forms, and particularly from *cahuilae,* in color and pattern. This is no slight difference exaggerated to appear important. So light colored are specimens of *cahuilae* compared to *humilis,* when viewed dorsally, that were it not for intermediate forms from other areas they might well be considered a distinct species. I am rather of the opinion we may find here, as with the gopher snakes *Pituophis catenifer annectens* and *Pituophis catenifer deserticola,* that while the ranges of the two forms are contiguous, and may indeed overlap in eastern San Diego County, there may be no intergradation, which, if it occurs, more probably takes place in another region or through a third subspecies. In alcoholic material the seven dorsal scale rows of *humilis* are colored a dark chocolate-brown, with a marked contrast between the dorsals and the ventrals. The edge of the brown may

closely follow the third scale row on each side of the median dorsal row or, more often, it is broken, engaging part or all of the fouth row, thus coloring a total of nine dorsal rows. Magnification shows the color application to be in the form of punctations so close together as to be virtually confluent.

Superficially *cahuilae* appears to be unicolor, without a dorsal-ventral contrast, but a close examination will reveal scattered light brown dots faintly obscuring the five median dorsal rows.

It must be understood that these color notes apply to preserved specimens, alcoholics in this case. Live specimens are so translucent that the colors are less apparent, but even in these the difference is sufficiently marked to have occasioned the following entry in my diary, upon receipt of the first live desert specimen of the species: "Noted today a worm snake from Agua Caliente Spring that I first thought might by *L. dulcis,* but it proved not to be. Very unusual in color, pink and transparent. Might be an albino, but the eye pigment is present." (Aug. 5, 1929). A corresponding entry for a coastal specimen describes the appearance in life as follows: "The color above is a uniform metallic brown, with the scale edges showing as a tracery of silvery lines. The lower surfaces are translucent white with the viscera showing through as dark patches. The eyes are black dots." (June 4, 1925). Thus there is a noticeable difference in life, accentuated as the colors become more opaque in preservation. It may be mentioned that the specimens of the two subspecies in my collection, having been preserved by a uniform process, are directly comparable.

In addition to the colors, we have, between *humilis* and *cahuilae,* a considerable average difference in dorsal scale counts, with slight overlapping between the maximum of the former and the minimum of the latter. In body form (ratio of length to diameter) there seems to be no difference.

Slevini is intermediate between *cahuilae* and *humilis* in pattern and color, being nearer the former in number of pigmented rows and the latter in color. Usually only five rows are punctated and these lightly or moderately, but the brownish dorsal tone is decidedly more in evidence than in *cahuilae,* and occasionally seven rows are engaged posteriorly. However, this Cape form differs from both of the others in the low dorsal scale count, in which character there is overlapping only in one specimen, and in the distinctly heavier body, as shown by the lower ratio of total length to diameter. With reference to the latter characteristic, it should be mentioned that averages, rather than extremes, are to be con-

sidered important, since distortion in preservation is likely to cause an occasional inaccurate figure.

I have stated that all specimens of these three subspecific forms, from within certain territories, fall consistently within the classification of the form inhabiting that area, the three areas being:

L. h. humilis: San Diego County from the coast to the crest of the divide.

L. h. cahuilae: The Colorado desert from the lower desert fringes of the Peninsula range to the east bank of the Colorado River.

L. h. slevini: The Cape region of Lower California.

There is, however, one very important exception, namely, the type of *L. humilis* itself, upon which it is necessary to comment at some length.

The type locality is given as Valliecitas, California, by Baird and Girard in the original description.[4] This has always been assumed to indicate Vallecito (pronounced in this neighborhood Vya-seé-tō), which was a stage station on the old Butterfield Route in eastern San Diego County. Miss Doris M. Cochran of the National Museum advises me that the original entry in the record book might be "Variecita" or "Varicata," the writing being rather poor. The situation is further complicated by the fact that Vallecitos (Little Valleys) are rather common in California, two others, one near Campo, the other near San Marcos, being located in San Diego County. We have three possible alternatives with reference to the actual locality of collection of this specimen:

1. It was collected at Vallecito, the now abandoned stage station, in eastern San Diego County.

2. It was collected near that point, but not necessarily at the station or even in the same life zone.

3. It was collected at some other Vallecito (or Variecita?) in California.

The importance of these three possibilities is due to the fact that Vallecito is located in a Lower Sonoran area in which, in later years, only *L. h. cahuilae* has been found, whereas the original description mentioning the "uniform chestnut-brown" dorsal color, admits of no classification other than *L. h. humilis*.

The type of *humilis* was collected by Dr. John L. LeConte in 1850. Dr. Jos. Grinnell has kindly called to my attention one of LeConte's

[4] 1853, p. 143.

publications (on Coleoptera) from which there is every evidence that he collected along the line of the then principal route between San Diego and Yuma including "Vallecitas," which leaves little doubt that it was the old stage station that was meant. This eliminates the third possibility. As to the other alternatives, a definite decision can probably never be reached. *L. h. cahuilae* has been taken at Agua Caliente Spring, which is three miles east of Vallecito, in the same dry wash and in the same life zone. *L. h. humilis* might be expected (but has not been actually collected) within five miles to the west of Vallecito, which would be in the Upper Sonoran life zone. Of course if LeConte, or some assisting army officer, had collected the specimen even ten or twenty miles west of Vallecito it would still no doubt have been filed under that locality, since this was the only named point in those days for many miles around.

So we must leave this problem undecided; the territories of *L. h. humilis* and *L. h. cahuilae* may or may not overlap in eastern San Diego County or the two may intergrade. Aside from the type itself, of somewhat uncertain locality, only one other specimen has been reported from the eastern foothills of the Peninsulas, which might logically be expected to be an area of intergradation if the two forms blend. This was Stephens' specimen from Banner,[5] which was in poor condition and has since disappeared. Thus we have every reason to look forward with interest to additional specimens from the desert foothills of this county.

Other Areas—Intergradations

We have seen that the snakes from the Cape region of Lower California, San Diego County and the Colorado Desert fall rather definitely into three territorial races. It now remains to classify, with the limited material at hand, the specimens from other areas.

Two specimens are available from central and northern Lower California, MVZ 10667 from San Ignacio with 277 dorsal scales and a length-diameter ratio of 45, and MVZ 9637 from San José (Lat. 31°) with corresponding figures of 274 and 53. Both of these specimens have seven medium brown dorsal rows. In color these snakes are intermediate between the San Diegan and Cape specimens; in numbers of dorsal scales they are above the San Diegan average. In the number of colored rows they resemble the San Diegan rather than the Cape specimens. One specimen is more like the Cape average in bodily form, but this is probably due to

[5] Copeia, No. 54, p. 34, 1918.

swelling from injection of preservative. Thus these specimens from the central and northern sections of the peninsula are best classified as *L. h. humilis* with an intergradative tendency toward *slevini,* as indicated by the light dorsal color.

From Cedros Island there is available a single dried specimen (CAS 8860). The dorsals probably number 254, thus approaching *slevini;* there are seven dorsal dark brown scale rows as in *humilis.* Probably the latter classification should be used. As this specimen is from an island containing several unique reptile forms,[6] this single specimen should not be considered of importance in determining the *humilis-slevini* relationship.

From California, north of San Diego County, so few specimens are available that definite conclusions are not to be drawn. The following table gives the data on those which we have:

Specimen Number		*Locality*	*Dorsals*	*L/D*	*Pattern*
LMK	98	Snow Creek, Riverside County	272	52	(5 solid brown, plus (2 moderate, plus 2 (faint brown rows
LA	218	Chatsworth Park, Los Angeles County	263	43	7 dark brown rows
USNM	56305	Los Angeles County	254	....	7 med. brown rows
USNM	56306	Los Angeles County	272	51	7 med. brown rows
USNM	18686	Near Bennett's Well, Inyo County	275	....	7 dark brown rows

It is to be noted that these specimens more nearly resemble *L. h. humilis* in the number of dark dorsal rows and their color; in reduced number of dorsal scales they show a tendency toward *slevini* (rather than toward *cahuilae* as might be more readily expected). It is to be regretted that more exact localities are not available for USNM 56305-6. They were collected by Julius Hurter, and as he is known to have worked in the vicinity of Claremont, it may be assumed that they come from the coastal, rather than the desert side of the mountains. We conclude that these California specimens from areas north of the type locality are to be classified as *L. h. humilis* although less sharply differentiated from the other subspecies than those from coastal San Diego County.

We next come to the Texas and the Arizona specimens, excluding

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6 *Uta concinna, Phrynosoma cerroense, Phrynosoma schmidti, Cnemidophorus multiscutatus, Cnemidophorus labialis, Crotalus exsul.*

those from the east bank of the Colorado, already included under *cahuilae*. These may be enumerated as follows:

Specimen	*Number*	*Locality*	*Dorsals*	*L/D*	*Pattern*
AMNH	8596	Fort Clark, Texas	269	55	7 medium brown
CAS	35325	Tucson	275	57	7 light brown
CAS	33835	Tucson	256	47	Pinkish. No contrast of dorsal with ventral color.
CAS	33836	Tucson	271	50	Pinkish. No contrast of dorsal with ventral color.
USNM	16952	Tucson	273	54	7 medium brown
USNM	17015	Tucson	276	56	7 medium brown
USNM	17016	Tucson	268	54	7 light brown
USNM	17017	Tucson	253	49	7 pinkish. Little contrast
CAS	33849	Santa Catalina Mts.	268	54	7 light brown
USNM	62564	Sabino Canyon, Santa Catalina Mts.	270	56	7 light brown
USNM	62565	Sycamore Canyon, Santa Catalina Mts.	252	....	7 light brown
AMNH	43439	Santa Rita Mts.	280	52	7 medium brown
USNM	65637	Cave Creek Dam, near Phoenix	279	51	7 medium brown

Here again we have a group which, in color, is intermediate between *slevini* and *humilis*. All have seven punctated rows except those in which no dots are visible; this, I am inclined to think, may be due to character of preservation. Several specimens have a lower range of dorsals than is characteristic of *humilis* in San Diego County, while the two westerly specimens are high in number of dorsals, thus indicating a tendency toward *cahuilae*, as might be expected.

But the situation is complicated by not knowing the altitudes and life zones in which the mountain specimens were taken. It is not impossible that some of the Tucson specimens were taken in the adjacent mountains, rather than at Tucson itself. Knowing what a difference a few miles make in San Diego County, we cannot but feel that a large number of specimens from Arizona, with highly accurate locality records, might produce a more logical and definite differentiation than is indicated in the above table.

Altogether I think the Texas and Arizona specimens may be classified at *L. h. humilis*, the easterly specimens from the plains area

showing an affinity toward *L. h. slevini* of the Cape region, or one of the Mexican forms, while those from the westerly desert area have a tendency toward *L. h. cahuilae*. Thus we have a situation comparable to that which exists amongst other reptile forms in the same areas.

From Mexico I have seen only one specimen in a condition of preservation sufficient to permit counting dorsal scales. This is USNM 48537 from Guanajuato with 239 dorsals and a body ratio of 43. The character and number of punctated dorsal rows cannot be determined. Mr. A. Loveridge kindly advises me that the type of Garman's *tenuiculum* from San Luis Potosí has seven light brown rows.

We may presume that the Mexican forms will have low dorsal scale counts, thus showing an affinity to *slevini,* but this is no more than a guess. The status of *dugesii* and *tenuiculum,* their relationships with the forms of *humilis* found in Texas and Arizona, and with *slevini* of the Cape region will have to await more material.

Aside from the differential characteristics which I have employed, I have been unable to determine others of importance. All specimens of *humilis* examined, of whatever subspecies, had fourteen rows of scales, with anal entire and two undivided plates (parietal and occipital) behind the ocular on each side. The lower labials are usually four on each side, but five are occasionally noted. It is so difficult to ascertain whether the nasal is divided in front of the aperture that this is not to be considered a useful character. The ratio of total length to tail length varies from about 17 to 27, averaging 22; this seems to have no subspecific significance.

Initially, having noted the fact that *L. humilis* appears common at the western limit of its range (San Diego County) but seems rare along the eastern boundary (Texas), and that a contrary condition exists with *L. dulcis,* it occurred to me that the presence or absence of supraoculars might be only of subspecific importance, *dulcis* gradually changing into *humilis* from east to west. But I note other differences between these two forms. From an examination of 21 specimens of *dulcis* from Mexico, Texas, Oklahoma, New Mexico, and Arizona, I find *dulcis* to have fewer dorsal scales than *humilis* (min. 209, max. 252, mean 230) and a lower ratio of total body length to diameter (min. 41, max. 53, mean 48). The infralabials are more frequently five than in *humilis.* In *dulcis,* as in Arizona specimens of *humilis,* there are usually seven medium to dark dorsal rows; occasionally there are but five. In *dulcis* the transition from the punctated dorsal rows to the immaculate ventrals is less sudden than in *humilis.* In *humilis* the rostral seems to be more divergent and wider at

the base than in *dulcis*. In *humilis* the first four median dorsal scales are usually wider than the following series, while in *dulcis* they are narrower. With these differences reinforcing the supraoculars it may be concluded that the species are distinct.

Field Notes—Habits

In San Diego County *L. humilis* seems to prefer stony rather than sandy areas. It must be largely subterranean, although the fact that two specimens have been found crushed by automobile traffic on the highway would indicate that it occasionally travels abroad. Most of the specimens brought to the San Diego Zoological Society during the past eight years were found under stones or during the course of excavations. In this period 38 worm snakes (7 *cahuilae*, the rest *humilis*) were reported out of a total of 6231 individuals of all species, thus constituting 0.6 per cent of the total and numbering fifteenth in order of frequency amongst the 29 species of snakes found in San Diego County.

The largest specimen measured was one from (Ft.) Yuma, Arizona, which was 337 mm. in length. A specimen from Yaqui Well, San Diego County, measured 304 mm., and one from San Diego (City) 302 mm.; thus *L. h. humilis* and *L. h. cahuilae* probably reach the same length. The smallest specimens measured about 90 mm. long and 1.8 mm. in diameter, being as long as and somewhat thicker than a large darning needle. One specimen contained eggs about 15 mm. long by $4\frac{1}{2}$ mm. in diameter. A specimen 245 mm. in length contained eggs.

This snake when above ground seems to progress with less lateral undulations than do other snakes. On smooth surfaces it attempts to employ the tail spine to aid in its motion. When placed in loose or sandy soil it burrows immediately. It is never peaceful or quiet when above ground, but continually searches for something in which to burrow; it is therefore difficult to photograph.

Some field notes follow:

Oct. 4, 1922: Three specimens were found in digging out the rotted butt of a fence post.

July 8, 1923: A specimen was found in a crack under a granite flake.

March 20, 1926: One was discovered under a rock flake.

March 28, 1926: Found a specimen under a flat rock; earth below, not another rock.

April 20, 1927: Found one under a thick flake leaning on a rock and touching the ground.

The food probably consists of termites and similar insects.

LOCALITY RECORDS

The definite locality records which I have been able to accumulate are given below. They are from the following sources: Locations mentioned in the literature; specimens borrowed from other institutions; localities from which I have collected specimens, or from which specimens have been brought to the Zoological Society of San Diego, the latter being almost exclusively from San Diego County.

Leptotyphlops humilis humilis

(This list includes not only specimens of the known typical form, but likewise all which cannot be specifically allocated to either of the two new subspecies. Thus we include all Mexican specimens which may belong to one or more other valid subspecies).

CALIFORNIA

San Diego County:

Valliecitas (=Vallecito?), Type locality
Red Mountain
Fallbrook
San Pasqual
Bernardo
Rancho Santa Fe
Lakeside
Grossmont
Lemon Grove
Sunnyside
Palomar
Rincon
Del Mar
La Jolla
Rose Canyon (=Ladrillo)
San Diego
Chollas Hts.
Valley Center
Wildwood
Viejas
Dulzura
Banner (subsp.?)

Riverside County:
Snow Creek

San Bernardino County:
San Bernardino
Slover Mt. (near Colton)

Los Angeles County:
Chatsworth Park

Inyo County:
Bennett's Well (Death Valley)

ARIZONA

Maricopa County:
Cave Creek Dam (near Phoenix)

Pima County:
Santa Rita Mts.
Tucson
Santa Catalina Mts.

Sabino Canyon (Santa Catalina Mts.)
Sycamore Canyon (Santa Catalina Mts.)

Texas[7]

Kinney County:
Fort Clark

Lower California

San Ignacio
San José (Lat. 31 deg.)
Cedros Island

Mainland Mexico

Colima, Colima. (Type locality of *dugesii*)
San Luis Potosí, San Luis Potosí. (Type locality of *tenuiculum*)
Guanajuato, Guanajuato
Talpa, Jalisco
Batopilas, Chihuahua
Presidio, Chihuahua?
San Miguel de Horcasitas, Sonora

Leptotyphlops humilis slevini
(All localities are in the Cape region of Lower California)

La Paz (Type locality)
Cape San Lucas
Eureka
San José del Cabo
San Francisquito
Sierra Laguna

Leptotyphlops humilis cahuilae

California

San Diego County:
Yaqui Well (Type locality)
Sentenac Canyon
San Felipe Wash
The Narrows
Agua Caliente Spr. (near Vallecito)
Imperial County:
Fort Yuma

Arizona

Yuma County:
(Fort) Yuma
Mohave County:
Fort Mohave

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[7] USNM 72346 from San Antonio, Texas, catalogued as *humilis*, appears to me to be *dulcis*.

TENTATIVE KEY TO DISTINGUISH THE WESTERN SUBSPECIES OF *Leptotyphlops humilis*

(Not complete for the entire species)

A. Scales in median dorsal row usually less than 260 and average 252; ratio of body length to diameter usually less than 50; 5 pigmented median dorsal scale rows ..... *slevini*

AA. Scales in median dorsal row usually number more than 260; ratio of body length to diameter usually over 50.

B. Seven or more dark brown dorsal scale rows; dorsal scales usually from 260 to 280 and average about 273 ..... *humilis*

BB. Five dorsal scale rows punctated with scattered light brown dots; dorsal scales usually exceed 280 and average about 289 ..... *cahuilae*

CONCLUSIONS

The worm snakes of the Californias belonging to the species *Leptotyphlops humilis,* centering in three areas from which adequate material is available, show sharp and definite differences and may be divided into three subspecies. A complete classification of the species must await more material, especially from Mexico.

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